Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Carbon nanotube springs with high tensile strength and energy density

Tong Wu[1], Jian Nong Wang[2,*]

[1] School of Materials Science and Engineering, Shanghai Jiao Tong University, 800 Dong Chuan Road, Shanghai 200240, P. R. China

[2] Nano Carbon Research Center, School of Mechanical and Power Engineering, East China University of Science and Technology, 130 Meilong Road, Shanghai 200237, P. R. China

***Corresponding author. E-mail: jnwang@ecust.edu.cn**

Video S1. CNT cylinder condensing on and wrapping a PVA wire.

Video S2. Twisting of the CNT fiber at high speed.

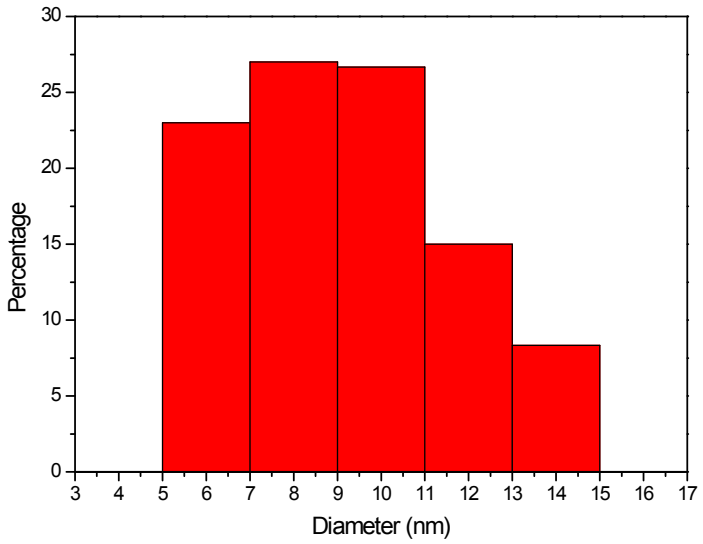


Figure S1. Diameter distribution of CNTs, based on the measurement of CNTs in a dozen of TEM micrographs.

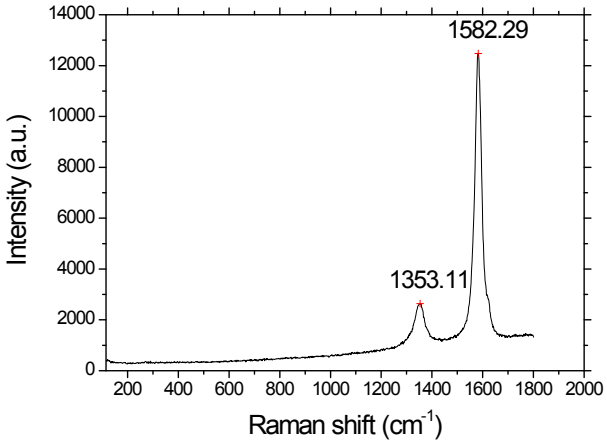


Figure S2. Raman spectrum of the CNTs. The G peak (~1590 cm^{-1}) is associated with tangential modes in pure sp^2 hybridized graphitic carbon, whereas the D peak (~1350 cm^{-1}) is related with disordered sp^3 type defects. The ratio of intensities of the G and D peaks, I_G/I_D, is generally used as an indicator of graphitization degree. The intensity ratio of the present CNTs was 4.7, indicating that the prepared CNTs had a good graphitic structure.

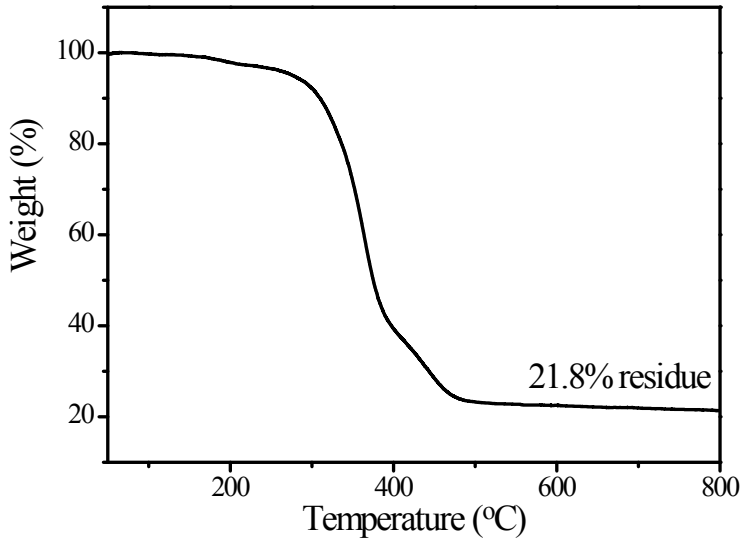


Figure S3. TG curve obtained in air. Assuming that the 21.8% residue is Fe_2O_3, the Fe content in the CNT sample is about 15% (by weight).

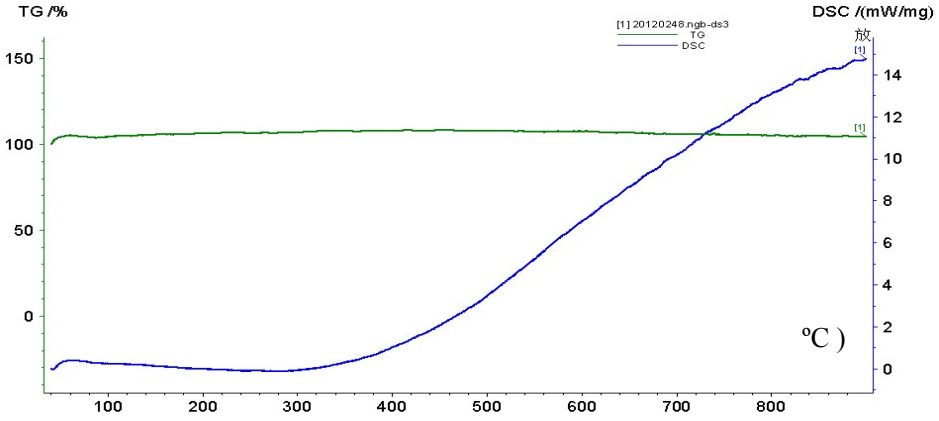
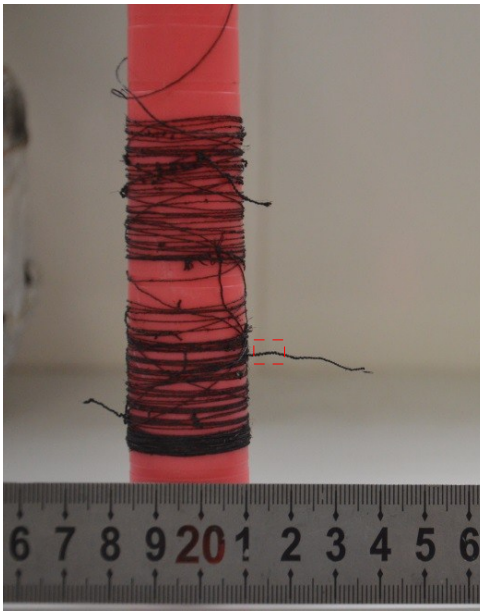


Figure S4. TGA result of the fiber after the dissolution of the enclosed PVA wire. The experiment was conducted with the protection of high purity N_2. The TG curve shows almost no weight loss, thus indicating complete removal of the PVA wire. If PVA were not completely removed, the TG curve would show weight loss because PVA decomposes at high temperature.



(a)

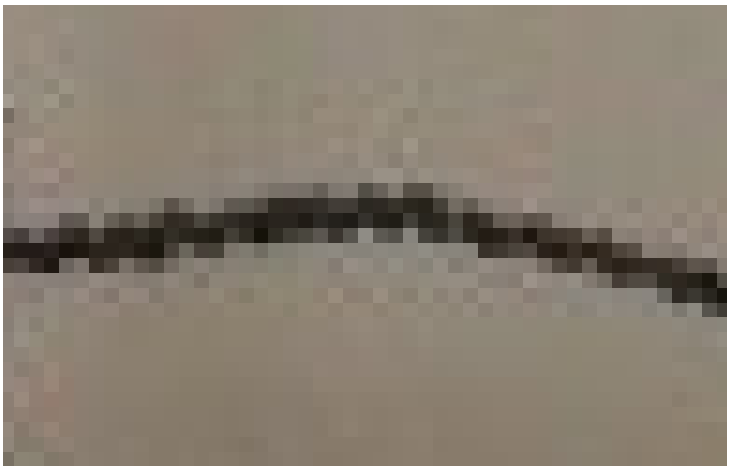

(b)

Figure S5. Optical image of winded long CNT springs. The image in (b) is the enlarged version of the red rectangular region in (a). The helical structure of the spring can be vaguely observed.